

What Is Claimed Is:

1 1. A method for detecting a thermal anomaly in a computer system,
2 comprising:
3 deriving an estimated signal for a thermal sensor in the computer system,
4 wherein the estimated signal is derived from correlations with other
5 instrumentation signals in the computer system;
6 comparing an actual signal from the thermal sensor with the estimated
7 signal to determine whether a thermal anomaly exists in the computer system; and
8 if a thermal anomaly exists, generating an alarm.

1 2. The method of claim 1, wherein generating the alarm involves
2 communicating the alarm to a system administrator so that the system
3 administrator can take remedial action.

1 3. The method of claim 2, wherein communicating the alarm to the
2 system administrator involves communicating information specifying the nature
3 of the thermal anomaly to the system administrator.

1 4. The method of claim 1, wherein comparing the actual signal with
2 the estimated signal involves using sequential detection methods to detect changes
3 in the relationship between the actual signal and the estimated signal.

1 5. The method of claim 4, wherein the sequential detection methods
2 include the Sequential Probability Ratio Test (SPRT).

1 6. The method of claim 1, wherein prior to deriving the estimated
2 signal, the method further comprises determining correlations between
3 instrumentation signals in the computer system, whereby the correlations can
4 subsequently be used to generate estimated signals for thermal sensors.

1 7. The method of claim 6, wherein determining the correlations
2 involves using a non-linear, non-parametric regression technique to determine the
3 correlations.

1 8. The method of claim 7, wherein the non-linear, non-parametric
2 regression technique can include a multivariate state estimation technique.

1 9. The method of claim 1, wherein the instrumentation signals can
2 include:
3 signals associated with internal performance parameters maintained by
4 software within the computer system;
5 signals associated with physical performance parameters measured
6 through sensors within the computer system; and
7 signals associated with canary performance parameters for synthetic user
8 transactions, which are periodically generated for the purpose of measuring
9 quality of service from an end user's perspective.

1 10. The method of claim 1,
2 wherein deriving the estimated signal for the thermal sensor involves
3 deriving multiple estimated signals for multiple thermal sensors in the computer
4 system; and

5 wherein comparing the actual signal with the estimated signal involves
6 comparing multiple actual signals with the multiple estimated signals to determine
7 whether a thermal anomaly exists in the computer system.

1 11. A computer-readable storage medium storing instructions that
2 when executed by a computer cause the computer to perform a method for
3 detecting a thermal anomaly in a computer system, the method comprising:
4 deriving an estimated signal for a thermal sensor in the computer system,
5 wherein the estimated signal is derived from correlations with other
6 instrumentation signals in the computer system;
7 comparing an actual signal from the thermal sensor with the estimated
8 signal to determine whether a thermal anomaly exists in the computer system; and
9 if a thermal anomaly exists, generating an alarm.

1 12. The computer-readable storage medium of claim 11, wherein
2 generating the alarm involves communicating the alarm to a system administrator
3 so that the system administrator can take remedial action.

1 13. The computer-readable storage medium of claim 12, wherein
2 communicating the alarm to the system administrator involves communicating
3 information specifying the nature of the thermal anomaly to the system
4 administrator.

1 14. The computer-readable storage medium of claim 11, wherein
2 comparing the actual signal with the estimated signal involves using sequential
3 detection methods to detect changes in the relationship between the actual signal
4 and the estimated signal.

1 15. The computer-readable storage medium of claim 14, wherein the
2 sequential detection methods include the Sequential Probability Ratio Test
3 (SPRT).

1 16. The computer-readable storage medium of claim 11, wherein prior
2 to deriving the estimated signal, the method further comprises determining
3 correlations between instrumentation signals in the computer system, whereby the
4 correlations can subsequently be used to generate estimated signals.

1 17. The computer-readable storage medium of claim 16, wherein
2 determining the correlations involves using a non-linear, non-parametric
3 regression technique to determine the correlations.

1 18. The computer-readable storage medium of claim 17, wherein the
2 non-linear, non-parametric regression technique can include a multivariate state
3 estimation technique.

1 19. The computer-readable storage medium of claim 11, wherein the
2 instrumentation signals can include:
3 signals associated with internal performance parameters maintained by
4 software within the computer system;
5 signals associated with physical performance parameters measured
6 through sensors within the computer system; and
7 signals associated with canary performance parameters for synthetic user
8 transactions, which are periodically generated for the purpose of measuring
9 quality of service from and end user's perspective.

1 20. The computer-readable storage medium of claim 11,
2 wherein deriving the estimated signal for the thermal sensor involves
3 deriving multiple estimated signals for multiple thermal sensors in the computer
4 system; and
5 wherein comparing the actual signal with the estimated signal involves
6 comparing multiple actual signals with the multiple estimated signals to determine
7 whether a thermal anomaly exists in the computer system.

1 21. An apparatus that detects a thermal anomaly in a computer system,
2 comprising:
3 an estimation mechanism configured to derive an estimated signal for a
4 thermal sensor in the computer system, wherein the estimated signal is derived
5 from correlations with other instrumentation signals in the computer system;
6 a comparison mechanism configured to compare an actual signal from the
7 thermal sensor with the estimated signal to determine whether a thermal anomaly
8 exists in the computer system; and
9 an alarm generation mechanism, wherein if a thermal anomaly exists, the
10 alarm generation mechanism is configured to generate an alarm.

1 22. The apparatus of claim 21, wherein the alarm generation
2 mechanism is configured to communicate the alarm to a system administrator so
3 that the system administrator can take remedial action.

1 23. The apparatus of claim 22, wherein the alarm generation
2 mechanism is configured to communicate information specifying the nature of the
3 thermal anomaly to the system administrator.

1 24. The apparatus of claim 21, wherein the comparison mechanism is
2 configured to use sequential detection methods to detect changes in the
3 relationship between the actual signal and the estimated signal.

1 25. The apparatus of claim 24, wherein the sequential detection
2 methods include the Sequential Probability Ratio Test (SPRT).

1 26. The apparatus of claim 21, further comprising a correlation
2 determination mechanism configured to determine correlations between
3 instrumentation signals in the computer system, whereby the correlations can
4 subsequently be used to generate estimated signals.

1 27. The apparatus of claim 26, wherein the correlation determination
2 mechanism is configured to use a non-linear, non-parametric regression technique
3 to determine the correlations.

1 28. The apparatus of claim 27, wherein the non-linear, non-parametric
2 regression technique can include a multivariate state estimation technique.

1 29. The apparatus of claim 21, wherein the instrumentation signals can
2 include:
3 signals associated with internal performance parameters maintained by
4 software within the computer system;
5 signals associated with physical performance parameters measured
6 through sensors within the computer system; and

7 signals associated with canary performance parameters for synthetic user
8 transactions, which are periodically generated for the purpose of measuring
9 quality of service from an end user's perspective.

1 30. The apparatus of claim 21,
2 wherein the estimation mechanism is configured to derive estimated
3 signals for multiple thermal sensors in the computer system; and
4 wherein the comparison mechanism is configured to compare multiple
5 actual signals with the multiple estimated signals to determine whether a thermal
6 anomaly exists in the computer system.